Technology Solutions That Work

Five school case studies exemplify the power of technology to enhance student's education.

BY CHERYL L. LEMKE

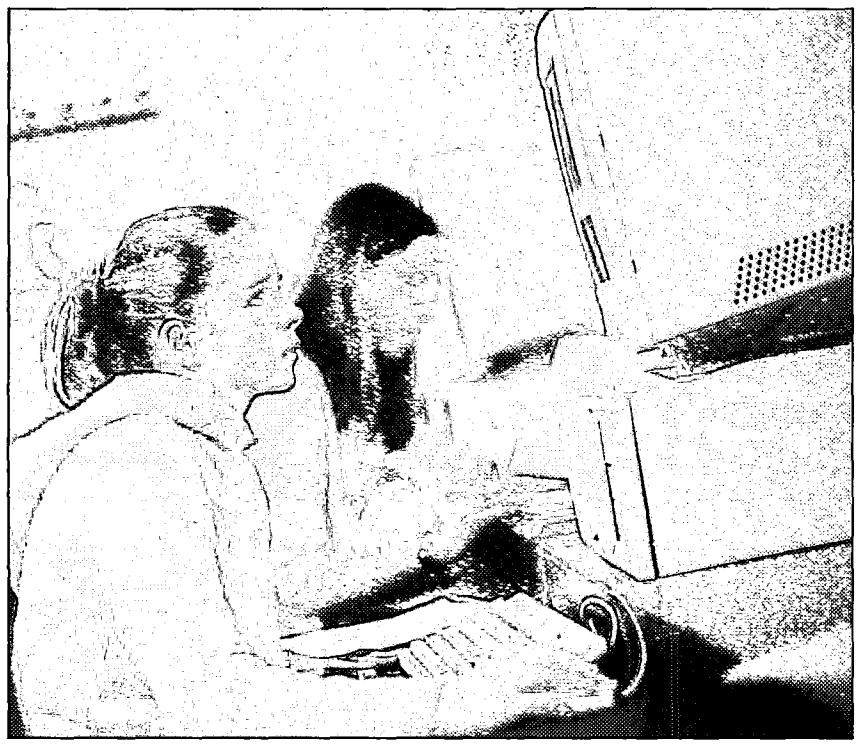
As is typical in many urban schools, West High School in Columbus, OH, had experienced high dropout rates (33%) and a low percentage of graduates attending college (30%). Then, in the mid-1990s, select groups of West High students were provided their own computers, both in school and at home. The initial result of this technology immersion was a changing role in the learning process for both students and teachers. But soon, the immersion had so shifted students' worldviews that its effect on their future became dramatic.

Through the program, students learned to communicate effectively about complex processes, became independent learners, developed expertise in content areas, began to work well collaboratively, and developed a positive outlook toward lifelong learning. Ninety percent of the students in that select group went on to college, compared to just 15% of their peers. Today, the students from the technology immersion group are 24 years old, with futures very different from what was expected.

Educators have been conducting research on the effect of technology in schools for several decades. It's now time to pay attention to what that research is telling us *works*. Imagine how different learning would be for all youngsters today if educators had paid serious attention to "what worked" at West High and had begun systematically requiring that such learning strategies and environments be implemented in all schools. But unfortunately for many students, experiences with learning and technology were (and still are) determined by the luck of the draw—the classroom to which they were assigned.

Don't let that happen in your school. Listen to what the research says. Make smart, informed decisions about technology and learning based on real data. Don't let anyone tell you there is no research on technology's effect on learning. Instead, follow this simple, common sense, seven-step approach:

1. *Follow the data.* Focus on the areas in which this evidence says your students are underperforming. Consider both academics and Digital Age literacies.
2. *Focus on sound learning in the content domain.* Conduct a review to identify current research on learning strategies that work in particular content domains. Consider also the general research on how people learn.
3. *Research technology-based solutions.* Conduct a second review to identify technology solutions that can support and add value to the type of learning that will best meet the needs of your students.
4. *Empower stakeholders to shape the new direction.* Engage a representative team in considering your



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findings and support them as they build a technology-supported learning plan to address student deficits.

5. *Define—and plan to track—your measures of success.* Establish a definition of success and associated metrics to track your students' and school's progress over time. Include measures at the student, teacher, classroom, school, and district levels to fully assess the context in which this shift in teaching and learning will take place. Each of these metrics must be tracked if you are to understand why technology-based solutions work in some classrooms and schools and not others.
6. *Establish a culture that supports data-driven innovation.* Establish communities of professionalism schoolwide and districtwide that honor and reward teachers for bringing effective, engaging, technology-based learning into their classrooms, advancing student achievement in the context of the digital age.
7. *Build the capacity of your staff to effectively implement the plan.* Professional development—based on scientific data and informed innovation—should be designed to systemically build the capacity of your staff to use technology wisely.

It is crucial to conduct this work systemically. Too often, teachers are expected to adopt effective uses of technology one by one, as a result of attendance at a one- or two-day workshop. Yet research tells us that unless school leaders engage teachers in systemic change, they will not be able to adopt and sustain effective uses of technology. It is up to you, as a member of the leadership team at your school, to formally establish a bridge between yesterday's learning environment and that of tomorrow.

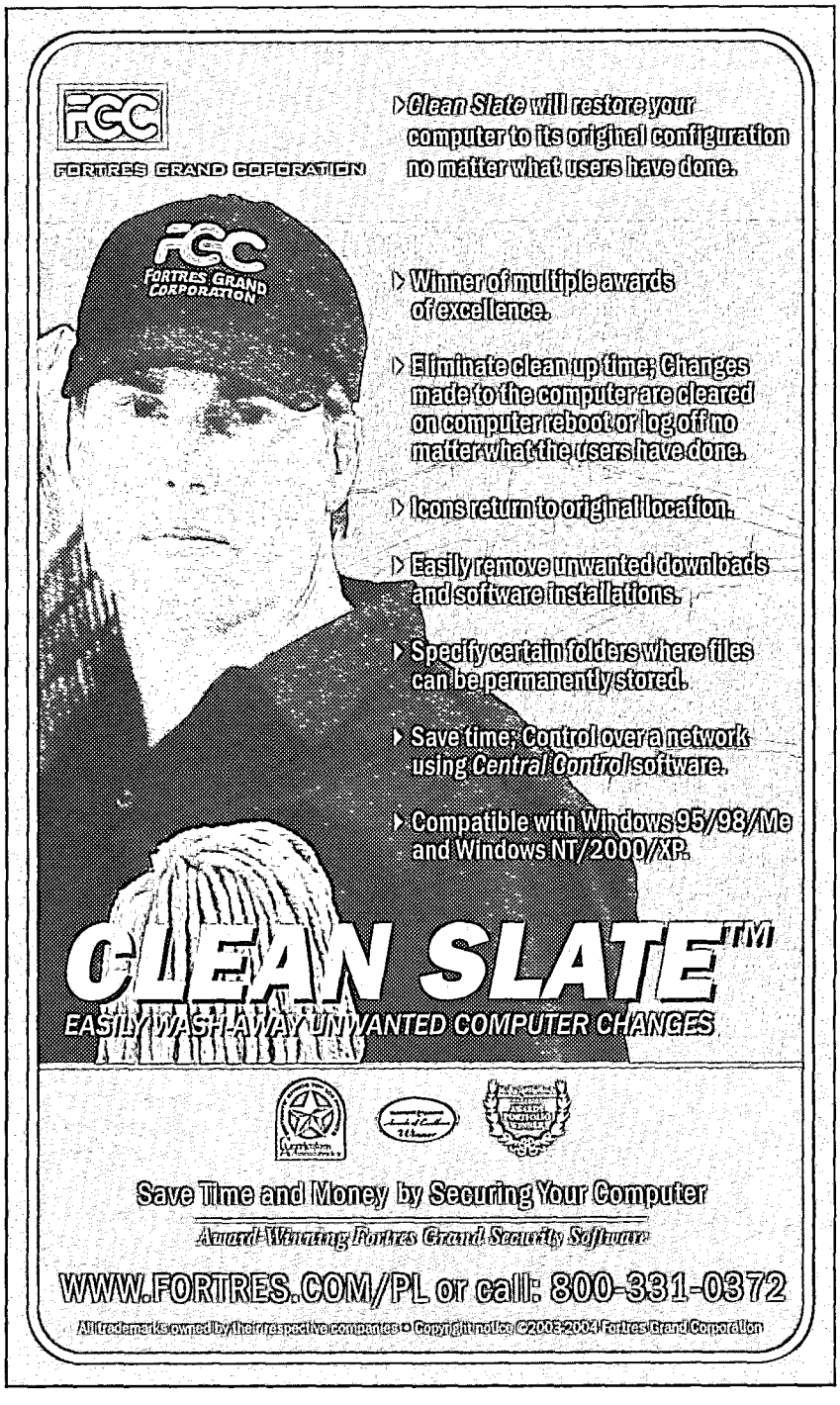
In the context of this seven-step process, consider the following examples of technology-based solutions that work. Each is grounded in emerging research on what we know about how people learn.

Example 1

Higher Achievement through Intellectually Stimulating, Authentic Learning
www.consortium-chicago.org/publications/p0a02.html

Program/research description: A Chicago school study by Fred Newmann, a professor at the University of Wisconsin, examined the effect of authentic, intellectually stimulating teacher assignments on academic achievement.

Newmann found that: "Student success in contemporary society requires not only basic knowledge and skills, but also the capacity to engage in more complex intellectual activity. Discussion of best instructional



practices or forms of assessment, however...[often implies] a trade-off between these two educational goals. The evidence...suggests that this [is] a false dichotomy."

What the research says: "Contrary to some expectations...high quality assignments were found in some very disadvantaged Chicago classrooms...and all students in these classes benefited from exposure to such instruction."

Implications for schools: Many educators believe that students must learn the "basics" before they can benefit from higher level, intellectually stimulating work. But with the technology now available to more easily engage students in relevant, real-world work, all students can be drawn as deeply into a subject area as experts in the field. Newman concludes that: "If teachers, administrators, policymakers, and the public at large place more emphasis on authentic, intellectual work in classrooms, yearly gains on standardized tests...could surpass national norms."

Example 2

Web-based Inquiry Science Environment

http://wise.berkeley.edu

Program/research description: The Web-based Inquiry Science Environment (WISE) is a free, online learning environment for students in grades 4–12. With support from the National Science Foundation, WISE students design, debate, and offer solutions to such contemporary scientific controversies as: deformed frogs, earthquakes, genetically modified foods, HIV, houses in the desert, malaria, plants in space, thermodynamics, water quality, and wolves.

Most activities are performed online; WISE software guides students through websites that provide content and "hints" to encourage reflection, data visualization, causal modeling, simulations, online discussion, and assessment. In addition, the Curriculum Library offers projects that can be easily incorporated into science curricula. WISE also offers a project-authoring environment in which teachers can customize projects or even create their own.

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What the research says: Research from the past 15 years about the role of technology in supporting scientific inquiry in the classroom forms the foundation of all WISE projects, which are designed to provide opportunities for students to reflect on material that may have been covered in class but hasn't yet been applied in relevant ways. Additional research shows that students who engage in WISE projects demonstrate reliable learning gains, as measured by assessments reflecting content and process standards. By performing activities in which they are asked to critique, compare arguments, and design solutions or models, students practice scientific reasoning and gain important perspectives on the nature of science.

Specific research has been conducted on several WISE projects. For example, Linn's (2000) research on the Heat and Temperature unit found that when students learn about a topic using textbooks only, a mere 10% of them understand the material and perform well on tests. However, when the WISE unit is used effectively, that number jumps to approximately 40%.

Implications for schools: WISE builds upon 15 years of research and is grounded in sound learning theory. Schools with students who do not meet science standards should consider using WISE units, provided that teachers are supported in professional development activities that enable them to implement the units as intended.

Example 3

Fast ForWord

www.scientificlearning.com

Program/research description: Fast ForWord is a CD-ROM- and Internet- based program that takes a unique, brain-based approach to reading by developing oral comprehension and other skills required for success.

Developed by neurological scientists from the University of California at San Francisco and Rutgers University, the program is a series of seven exercises that train students to understand, process, and use language effectively. Exercises are specifically targeted to developing discrimination skills that have been identified through neurological research as strongly related to success in reading. These include phonemic awareness, auditory processing, phonological awareness, working memory, syntax, grammar, and sequencing.

What the research says: In 1994 and 1995, researchers from UCSF and Rutgers conducted controlled studies to measure the effectiveness of Fast ForWord. Students showed rapidly improved language skills. On tests of early reading and language skills, Fast ForWord students started in the 12th percentile and ended in the 49th.

Further research involved a National Field Trial in 1996 with a much larger sample. These and other results confirmed the findings of the earlier studies.

Implications for schools: This is a program that must be implemented as recommended to achieve the desired achievement gains—but it does work. Although the program is expensive—the cost for 50 students can be approximately $38,000—it includes software, training, and daily assessment of students' progress and assignment of new work via the Internet. Designed for children ages 4–12, there may be benefits to older students as well; several concepts involved in the program have even been applied to adult learners.

Example 4

Sunnyside Elementary School, Pullman, WA

www.psd267.wednet.edu/%7Ekfranz/index.htm

Program/research description: Since 1993, Kristi Rennebohm Franz and her colleagues at Sunnyside Elementary have been using technology to generate opportunities for students to read and write about meaningful curricular content with local and global peers.

Using the International Education and Resource Network (iEARN) to connect with K–12 schools worldwide, children in Franz's classroom have been engaged in local-to-global collaborative curricular projects in social studies, science, math, language, and visual arts. All projects are embedded in service learning and are based on a philosophy of building human understanding to make the world a better place.

What the research says: Franz uses Harvard's Teaching for Understanding, the iEARN philosophy, and a host of research-based approaches to learning in her classroom. She has carefully documented how her first and second grade students consistently exceed state and national standards in reading, writing, mathematics, science, and other academic areas as a result. Franz's work was featured at the U.S. Department of Education's 2000 Secretary's Conference on Educational Technology, and is

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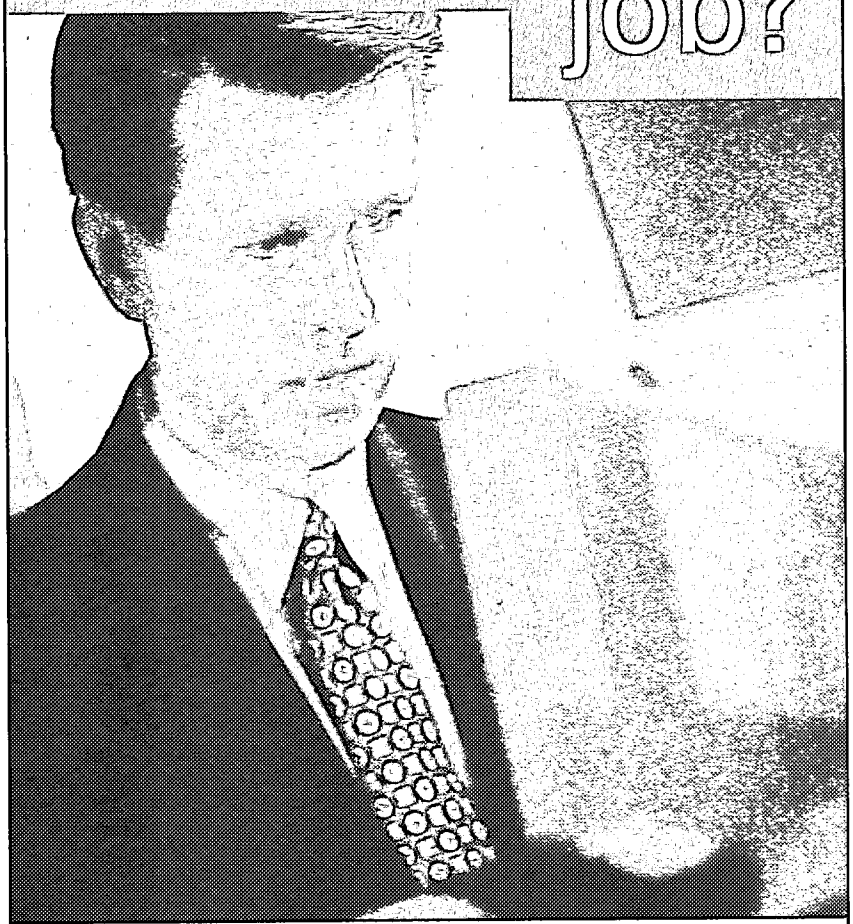

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currently highlighted on NCREL's enGauge website.

Implications for schools: Teachers at Sunnyside use iEARN effectively in their elementary classrooms, but the network can benefit students of all ages. Launched in 1988, the nonprofit global iEARN network of more than 3,000 schools in 61 countries engages students in collaborative educational projects designed to enhance curricular learning while enabling students to make a difference in the world. Students and teachers can join these interactive, project-based partnerships for a nominal fee, using threaded online discussion areas, email, and 24-hour videoconferencing to work interactively with peers around the globe.

Example 5

IMMEX

www.immex.ucla.edu

Program/research description: IMMEX is problem-solving and assessment software. It serves as a "shell" for the development of a problem-solving situations. Teachers can stage a class through IMMEX, which allows IMMEX to track each of the actions students make when attempting to solve a problem. IMMEX then records these actions for the teachers to view and analyze. Web problems are available for grades K–12 and encompass many scientific and nonscientific disciplines. Once students complete the exercises, they are given a visual map of how their problem solving approach compared to that of "experts." That opportunity helps students reflect on their problem-solving strategies.

What the research says: The Department of Education has recognized the IMMEX project as one of the country's exemplary programs influencing the use and innovation of technology in classrooms in the United States. Teachers workshop participants' responses also showed statistically significant improvement in their preparation to:

> **"Although most educators understand the need to align schools to today's knowledge-based, technological society, few schools are effectively using technology to raise student performance.**

- Use cooperative learning groups
- Present applications of concepts
- Use computers as an integral part of instruction
- Manage a class of students who are using hands-on/laboratory activities
- Use a variety of assessment strategies
- Use performance-based assessment
- Teach groups that are heterogeneous in ability
- Take students' prior conceptions into account when planning curriculum and instruction. (WestEd, 1998)

Implications for schools: A recent study on IMMEX by Boston College researchers finds that "without instructional intervention, students appear highly unlikely to change problem-solving strategies, even if those strategies seldom produce a correct answer." IMMEX can serve as a window into the thinking of students and a tool for teachers to use in providing the instructional intervention necessary to advance students' expertise in problem solving. (Boston College, www.jtla.org)

Conclusion

Given the realities of globalization, knowledge work, and accelerating societal change, it's obvious that *what* students learn—as well as how and when they learn it—must change.

Although most educators understand the need to align schools to today's knowledge-based, technological society, few schools are effectively using technology to raise student performance. Research clearly demonstrates that technology can serve as a bridge to more engaged, relevant, and personalized learning—all of which lead to higher academic achievement.

Additional examples of important research-based solutions can be found at:

- ❑ The Metiri Group www.metiri.com/resources.html
- ❑ The ISTE (International Society for Technology in Education) http://caret.iste.org
- ❑ NCREL (North Central Regional Educational Laboratory) enGauge www.ncrel.org/engauge/framewk/efp/efpin.htm
- ❑ The electronic journal of technology, learning, and assessment www.bc.edu/research/intasc/jtla.html

In this era of high-stakes testing, it is extremely important to demonstrate this crucial link to teachers, school administrators, curriculum directors, and staff development coordinators. Using this strong research base within the seven-step process will serve as a foundation for the systemic school change required if schools are to use technology to raise academic achievement as they advance digital literacy. **PL**

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